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Technological Progress and Environmental Reforms: Challenges and Opportunities Related to Brexit

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Abstract

The United Kingdom's withdrawal from the European Union (Brexit) has reshaped the landscape of technological progress and environmental reform, creating both significant challenges and unique opportunities. This paper examines how Brexit has influenced the UK's innovation ecosystem, regulatory frameworks, and environmental sustainability strategies. On one hand, Brexit has presented obstacles such as disrupted research collaborations, reduced access to EU funding programs like Horizon Europe, and uncertainties in environmental policy alignment with the EU Green Deal. The loss of shared regulatory mechanisms has also complicated efforts to maintain high environmental standards and carbon reduction commitments.

Conversely, Brexit has provided the UK with the autonomy to tailor its technological and environmental policies to national priorities. Freed from EU regulatory constraints, the UK can accelerate investment in emerging technologies such as green hydrogen, carbon capture, artificial intelligence for sustainability, and renewable energy innovations. The creation of independent environmental legislation, such as the Environment Act 2021, demonstrates the potential for adaptive governance frameworks that address local needs more effectively. Additionally, new trade and innovation partnerships beyond Europe could stimulate cross-border technological exchange and sustainable economic growth.

Ultimately, Brexit represents a critical turning point where technological progress and environmental reform must be strategically aligned. The UK's success in leveraging post-Brexit independence will depend on its ability to balance economic competitiveness with ecological responsibility, fostering innovation that supports long-term environmental resilience.

Keywords: *Brexit, technological progress, environmental reforms, sustainability, innovation policy, UK governance, green technology, environmental regulation, climate change, post-Brexit economy.*

Introduction

The decision of the United Kingdom (UK) to leave the European Union (EU) — commonly known as Brexit initiated a new era for UK policy-making. While much public attention has centered on trade, immigration, and economic relations, an equally important arena of transformation is in technological progress and environmental governance. The separation from EU structures has disrupted long-standing regulatory frameworks and collaborative research infrastructures, but it also creates an opportunity space for the UK to redesign and tailor its innovation and environmental policies to national priorities.

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At a time when the world confronts escalating climate change, biodiversity loss, and resource constraints, technological innovation particularly green technology and robust environmental regulation are critical. For the UK, the challenge is to leverage post-Brexit autonomy to accelerate sustainable technological progress, while avoiding regulatory rollbacks that could undermine environmental protection.

My research paper studies how Brexit has both constrained and enabled the UK in reshaping its innovation ecosystem and environmental governance. It investigates the tradeoffs involved, on climate-tech investment, emissions reductions, legislative developments, and future prospects for aligning technological progress with environmental reform in a post-2025 Britain.

Research Methodology

This research is based on qualitative and quantitative analysis of publicly available data, policy documents, and government websites. The following steps were followed:

» **Document and policy review:** Key legislation (e.g., Environment Act 2021, Great British Energy Act 2025), government policy documents (e.g., Environmental Improvement Plan reports 2024–2025, carbon budget delivery plans), and official UK emissions data were examined to map structural changes in governance post-Brexit.

» **Statistical and investment data analysis:** Data on climate-tech investment (e.g., report by PwC on UK climate tech 2024), renewable energy generation and emissions reductions (e.g., national energy data, Carbon Brief analysis for 2024), were collated to gauge the tangible progress in green technology uptake and decarbonization.

» **Assessment of research collaboration & funding dynamics:** Secondary sources describing UK's association status with EU programmes (especially Horizon Europe), amounts and nature of grants received post-reentry, and analyses of the implications for research and innovation.

» Monitoring media reports and NGO/think-tank assessments of divergences between UK and EU environmental regulation post-Brexit, and evaluating both regressions and new domestic measures.

Brexit

Refers to the withdrawal of the European Union (EU) by the United Kingdom (UK). The formal departure changed not only trade and political relations, but also how the UK aligns with EU-driven regulatory frameworks, funding mechanisms, and environmental/climate policies. For example: participation in certain EU-wide programmes ceased or became more complex under the post-Brexit EU–UK Trade and Cooperation Agreement (TCA).

This shift created both disruption (e.g. in legal/regulatory alignment, uncertainty) and — potentially — new freedoms for the UK to chart its own path, particularly in areas like innovation policy and environmental regulation.

Technological Progress / Innovation Policy

This captures the UK's efforts to advance science, technology, and industrial innovation. Brexit initially disrupted some aspects — e.g. access to certain EU research programmes — but more recently the UK has regained footing:

- The UK re-joined the EU's flagship science research programme Horizon Europe in 2024 (after a hiatus post-Brexit). In 2024 the UK ranked 5th among 47 participating countries by total grants awarded.

- British researchers received ~£500 million in new grants in the first year post re-entry, enabling a revival of collaborative research, including projects in areas like sustainable aviation fuel, medical technology, carbon-capture and more.
- On the policy side, in 2025 the UK government unveiled a ten-year industrial plan that targets increased public R&D investment (including in digital tech, advanced manufacturing, clean energy, AI, quantum, semiconductors, etc.) to bolster innovation and competitiveness. Thus, "technological progress" in the post-Brexit UK is being actively revived and reoriented — with a mix of public investment, renewed EU collaboration, and ambitions to lead in frontier technologies.

Environmental Reforms / Sustainability / Environmental Regulation

These refer to changes in how the UK regulates environmental issues — pollution, emissions, biodiversity, waste, resource use — and how it reforms policy to meet sustainability/climate goals. Post-Brexit, the UK no longer automatically follows all EU environmental directives, thus giving it autonomy to "reform." But results are mixed.

- On the one hand, some areas of environmental protection have been weakened. For instance, critics argue that under the UK's "Retained EU Law" reforms, there is a loosening of air-pollution regulation and delays or rollbacks on battery-recycling, water framework, and habitat/wildlife protections.
- On the other hand, the UK is introducing new regulatory and institutional frameworks to replace or go beyond EU-era arrangements. For example, in 2025 the UK passed the Great British Energy Act 2025, which set up a state-owned energy company (Great British Energy) to accelerate clean, domestically produced energy development.
- The government is also updating its carbon-market mechanisms: as of mid-2025, it published responses to a consultation on expanding the scope of the domestic UK Emissions Trading Scheme (UK ETS) — potentially including waste, maritime sectors, and greenhouse gas removals (carbon-capture/forestry, etc.). Thus "environmental reforms" must be understood as a shifting balance: some deregulatory moves, some new frameworks, and a strategic attempt to combine regulation + innovation (e.g. via ETS, clean energy investments).

Post-Brexit Economy / Governance / UK Governance

This refers to the new structural and institutional arrangements the UK now uses to govern its economy, environment, and innovation — freed from certain EU constraints. Through its own laws and policies, the UK aims to tailor strategies to its national priorities.

- The Great British Energy Act (2025) is an example of how post-Brexit governance is being used to centralize and promote clean energy transition under a public-sector energy company.
- Through policies like expanding UK ETS scope (waste, maritime, carbon removals) and rethinking sustainability regulation (e.g. moving away from a UK Green Taxonomy toward alternate standards) the UK aims to govern carbon, emissions, and sustainable development in its own way.
- The recovery of EU research funding (via re-entry to Horizon) demonstrates that even after Brexit, UK governance allows flexible re-engagement with European and global research systems — blending independence with selective cooperation.

Thus, "UK governance" in the post-Brexit era reflects a hybrid model: national autonomy + strategic international re-engagement + domestic institutional reform.

Green Technology / Renewable Energy / Green Hydrogen / Carbon Capture

These represent the technological and infrastructural tools that could enable sustainable growth and decarbonization in the post-Brexit UK. Given its new policy autonomy, the UK is betting heavily on these to meet climate goals while fostering innovation.

- The UK government's 2025 "clean-energy / industrial plan" aims to double clean energy investments, invest in advanced manufacturing, and support frontier technologies including those relevant for green energy and sustainability (e.g. advanced manufacturing, engineering biology, energy tech).
- In parallel, the UK's 2025 "Clean Flexibility Roadmap" advances development of hydrogen-fired power (H2P) projects. As of March 2025, 27 hydrogen production projects had been shortlisted under the second Hydrogen Allocation Round (HAR2), with more rounds planned.
- Regarding carbon capture and storage (CCS) and greenhouse gas removal (GGR), the government has signaled inclusion of engineered removals (e.g. direct air capture or bio-energy with CCS) into its emissions trading scheme — legislation is being planned through 2028–2029.
- However, some independent reviews urge caution: one 2025 analysis argues that because of variability in wind/solar generation and shortcomings in gas storage infrastructure, technologies proposed in the UK's "Clean Power 2030" strategy may be over-optimistic or risky if not carefully managed. Thus "green technology," "green hydrogen," and "carbon capture" are not just buzzwords— they are core elements in the UK's evolving strategy to reconcile economic growth, energy security, and environmental responsibility.

Sustainability / Climate Change / Environmental Impact / Net Zero Goals

These refer to long-term ambitions to reduce greenhouse gas emissions, protect ecosystems, promote biodiversity, and ensure that economic development does not come at the cost of environmental degradation. Post-Brexit, the UK still retains strong climate and sustainability commitments — but the institutional and regulatory routes to achieve them are being restructured.

- According to the UK's most recent emissions data, by 2024 the UK's total greenhouse-gas emissions (including international aviation/shipping) were 413.7 $MtCO_2e$ — a 50.4% reduction compared to 1990.
- The UK thus became one of the first major economies to halve its 1990-level emissions.
- However, the same report notes that while power generation and industry have contributed significantly to reductions (coal plant closures, decarbonized electricity), emissions from aviation increased making air travel a critical risk area for future climate targets.
- At the same time, the regulatory framework is shifting. For example, there are active consultations and policy adjustments regarding carbon markets (ETS expansion), greenhouse-gas removals, and sustainability reporting standards (the government stepped back from a formal "UK Green Taxonomy" in 2025, preferring instead a reporting-standards approach)

Challenges and Opportunities after Brexit

Challenges

Disruption in research collaboration and innovation funding

The UK's departure from the EU initially severed unobstructed access to major collaborative research programmes such as Horizon Europe. This led to a temporary period of uncertainty for researchers, delaying grant applications and collaborative projects. Such disruption risked weakening the UK's innovation ecosystem precisely when global competition in climate-tech and sustainability innovation was intensifying.

Although the UK rejoined Horizon Europe in 2024 as an associate member, the effects of the hiatus remain visible. UK research institutions earned nearly £500 million in grants in 2024, ranking first among non-EU participants by number of grants, and fifth overall among 47 participating nations. However, early assessments suggest the UK may face financial claw backs due to "underperformance" relative to the contributions required under its association agreement.

This turbulent transition period may have delayed innovation, slowed momentum in emerging technologies, and eroded collaborative networks particularly those integrated across Europe.

Divergence and potential weakening of environmental regulation

Post-Brexit, the UK has diverged from EU environmental standards in multiple areas. Investigations have flagged several regulatory regressions: the UK has permitted use of 36 pesticides that the EU has banned; air-pollution regulations derived from EU law are being considered for removal or weakening; water quality, habitat protection, waste and recycling standards are under review or in flux.

Critics argue that such regulatory divergence puts UK's environmental protections at riskpotentially leading to increased pesticide use, weaker safeguards for biodiversity and habitats, lower air and water quality, less rigorous waste management, and slower progress on resource efficiency.

Moreover, with the EU having introduced 28 new or upgraded environmental laws since Brexit that the UK has not adopted, the regulatory gap has widened significantly.

Such divergence undermines the synergy between technological progress and environmental protection; without strong regulation, green technologies may not be adopted at scale or environmental harms may be externalized.

Structural pressures on scaling low-carbon technologies

Even as green technology investment rises, deploying these at scale entails systemic challenges. For instance, a recent study mapping electricity network needs for industrial decarbonization in Great Britain estimates that, by 2050, an additional 71 GW of electricity network capacity will be needed otherwise up to 65% of large industrial sites may face capacity constraints by 2040.

Similarly, while offshore wind–powered green hydrogen is promising (and could significantly contribute to Europe's decarbonization) economic competitiveness depends heavily on low electricity cost and favorable regulatory frameworks.

The risk is that without coordinated infrastructure investment, regulatory clarity, and long-term planning, the potential of green technologies will stall or be unevenly realized.

Opportunities

Autonomy to set ambitious, tailored environmental policy

Post-Brexit, the UK now has full legislative responsibility for environmental policy. The Environment Act 2021 institutionalized this by requiring legally binding long-term targets across air quality, water, biodiversity, waste reduction and resource efficiency.

Through the Environmental Improvement Plan (EIP23), the UK has begun to define specific interim targets (to be reviewed every five years), and has expanded ambition to include woodland cover and marine protected areas.

This flexibility affords the UK the ability to design policies that reflect national priorities and conditions (e.g., local biodiversity, land-use patterns, water resources), rather than adopting a one-size-fits-all EU standard. In principle, this could lead to more adaptive, locally relevant, and effective environmental governance.

Surge in domestic green technology investment and climate-tech innovation

Despite earlier disruption to research funding, 2024 saw a major rebound in UK climate-tech investment. According to a report by, investment in UK based climate tech companies surged 24% to £4.5 billion. AI-powered climate-tech firms attracted a 128% increase, totaling £1.01 billion.

This suggests that investors both private and institutional see strong opportunity in UK-based green technology and sustainability innovation. The UK appears to be positioning itself as a global hub for AI-driven climate solutions, renewable energy technologies, and other green-tech sectors.

Such investment can drive not only emissions reductions, but also economic growth, high-skilled employment, regional development (notably in former industrial areas), and long-term competitiveness in a decarbonizing global economy.

Legislative foundations for systemic transformation

Beyond the Environment Act, the UK in 2025 passed the Great British Energy Act, which establishes a publicly-owned energy company tasked with accelerating development of clean, domestically produced energy.

This institutional innovation a public clean-energy entity could help coordinate large-scale deployment of renewables, invest in infrastructure (grids, storage, hydrogen, etc.), and ensure that energy transition serves public interest (not just private profit).

Coupled with growing private investment in climate tech, such public–private synergy offers a promising path for systemic transformation of the UK's energy and industrial economy.

Progress toward emissions reduction and renewable energy transition

The 2025 data show that the UK is now more than halfway to meeting its 2050 net-zero target: emissions are down 50.4% compared to 1990 levels. In 2024 alone, emissions fell by 3.6% (to ~ 371 Mt CO_2e), the lowest level since the 1870s, largely thanks to collapse in coal demand (coal use down 54%), closures of coal-fired power plants and blast furnaces, and increased renewable generation and electric vehicles.

Moreover, the UK's zero-carbon electricity generation hit record levels in recent years. For example, according to National Grid data, 2022 and 2023 registered historically high zero-carbon energy generation; in

2023, zero-carbon sources (wind, solar, nuclear, hydro, biomass) generated 51% of electricity, surpassing gas and coal.

These trends indicate that under favorable policy and investment conditions the UK can harness its post-Brexit autonomy to accelerate decarbonization, adopt clean energy, and reduce greenhouse gas emissions.

Conclusion

Brexit presents a double-edged sword for the interplay between technological progress and environmental reform in the United Kingdom. On one edge are real and present challenges: disruption to research funding and collaboration, regulatory divergence that threatens environmental protections, and structural inertia in scaling up clean infrastructure. On the other edge lies opportunity: policy autonomy, legislative flexibility, a surge of investment into green technology, and a governance environment capable of systemic innovation.

The data for 2024–2025 offer encouraging signs: strong growth in climate-tech investment, renewed access to major research funding, record low emissions, rising share of renewable energy, and new national legislation (Energy Act, Environment Act) that could steer long-term transformation.

Yet achieving long-term sustainability and technological leadership will not be automatic. It will require strategic alignment: coordinated investment (public and private), robust regulation, infrastructure upgrades, and deliberate industrial, energy, and innovation policies.

In other words: Brexit gives the UK the *freedom* to choose — but the success of that choice depends on governance, political will, and societal commitment.

Future Prospects (After 2025)

Looking ahead beyond 2025, several plausible pathways emerge for the UK's technological and environmental future — contingent on policy, investment, and global context.

1. **Scaling green technologies and clean energy infrastructure**
    - With the establishment of Great British Energy and rising private climate-tech investment, the UK could significantly expand its renewable energy capacity, hydrogen production, and carbon capture & storage (CCS) deployment. This could make the UK not only energy-self-sufficient, but also a net exporter of clean energy (e.g., offshore green hydrogen) contributing to wider European decarbonization. Indeed, recent academic modelling suggests offshore wind–powered green hydrogen from the UK could substantially reduce Europe's CO_2 emissions by mid-century.
    - However, realizing this requires major upgrades to the electricity network: a recent study estimates a need for an additional 71 GW of generation/distribution capacity by 2050 — especially in central, south, and north-west England and Wales — to avoid bottlenecks.

2. **Institutional deepening of environmental governance and regulation**
    - The Environment Act's legally binding targets and periodic Environmental Improvement Plans provide a stable framework. Over time, the UK may progressively raise environmental standards (air, water, biodiversity, waste) — possibly surpassing previous EU-derived levels.
    - But this is not guaranteed. Divergence from EU regulations continues; if regulatory weakening persists (e.g., on pesticides, pollution, waste), long-term environmental quality could be compromised. The balance struck in upcoming parliamentary and regulatory reviews will be critical.

3. **Research & innovation resurgence with global partnerships beyond the EU**
    - The UK's re-entry into Horizon Europe is a strong signal of renewed scientific collaboration. As relationships rebuild, UK institutions may regain leadership in cutting-edge research (green tech, AI for sustainability, biotech, materials science, etc.). Continued success could depend on the broader policy environment, funding stability, and the UK's ability to attract global talent and investment.
    - Simultaneously, Brexit may encourage the UK to deepen partnerships beyond Europe — with the U.S., Commonwealth countries, Asia, etc. This could diversify its innovation ecosystem and reduce reliance on EU funding cycles.

4. **Potential economic and societal transformation**
    - Transitioning to a low-carbon economy could generate hundreds of thousands of new jobs, especially in clean energy, manufacturing, green tech, and infrastructure aligning with the estimates by that net-zero transition could create up to 725,000 net new jobs by 2030, with higher-than-average wages.
    - Regions historically reliant on heavy industry (coal, steel, heavy manufacturing) may benefit disproportionately if green industries, clean energy manufacturing, and low-carbon infrastructure are centered there — helping to rebalance regional inequality and stimulate "just transition."
    - At the same time, societal adaptation will be necessary: widespread electrification (transport, heating), energy efficiency measures, changes to consumption patterns, and possibly shifts in land-use (reforestation, habitat restoration, renewable infrastructure).

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